

## The Earth is an Efficient Place to Reject Heat in Summer...



74°F

Outdoor air  
design temperature:  
98°F in summer  
  
Delta T = \$ to operate!!!

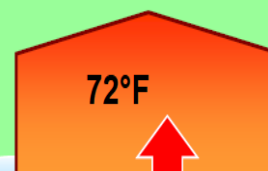
Insulating layer of earth



72°F

A geothermal heat pump cools the building in summer by rejecting heat into the earth

## ...and is the Source of Stored Heat in Winter...



72°F

Outdoor air  
design temperature:  
38°F in winter  
  
Delta T = \$ to operate!!!

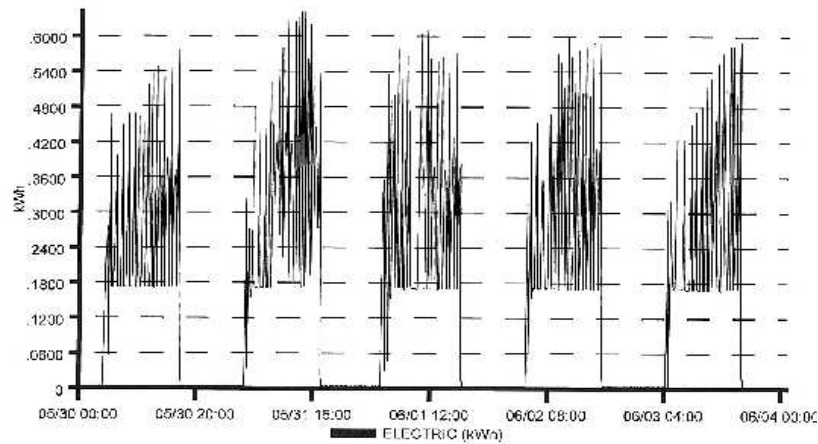
Insulating layer of earth



80°F

➤ A geothermal heat pump takes heat from the earth during winter and transfers it into the building

## Load Profile Report



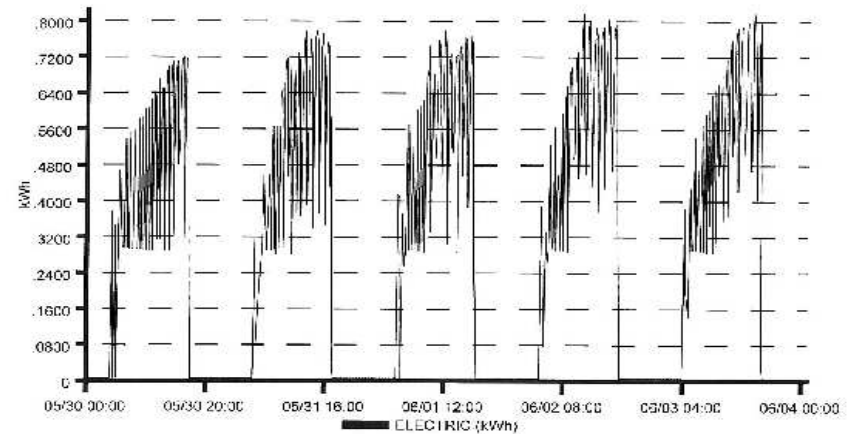
Reporting Period: From 05/30/2011 to 06/03/2011  
Selection:

ELECTRIC

### Meter Reading Statistics

Max (¼ h) Demand	2.590 kW at 05/31 13:45	Peak ¼ hour	0.940 kWh at 05/31 13:45
Min ¼ hour	0.001 kWh at 05/30 00:30	Total	78.407 kWh
Avg	0.163 kWh	LF	26.62%
Estimated #s CO2	72.134		

## Load Profile Report



Reporting Period: From 05/30/2011 to 06/03/2011  
Selection:

ELECTRIC

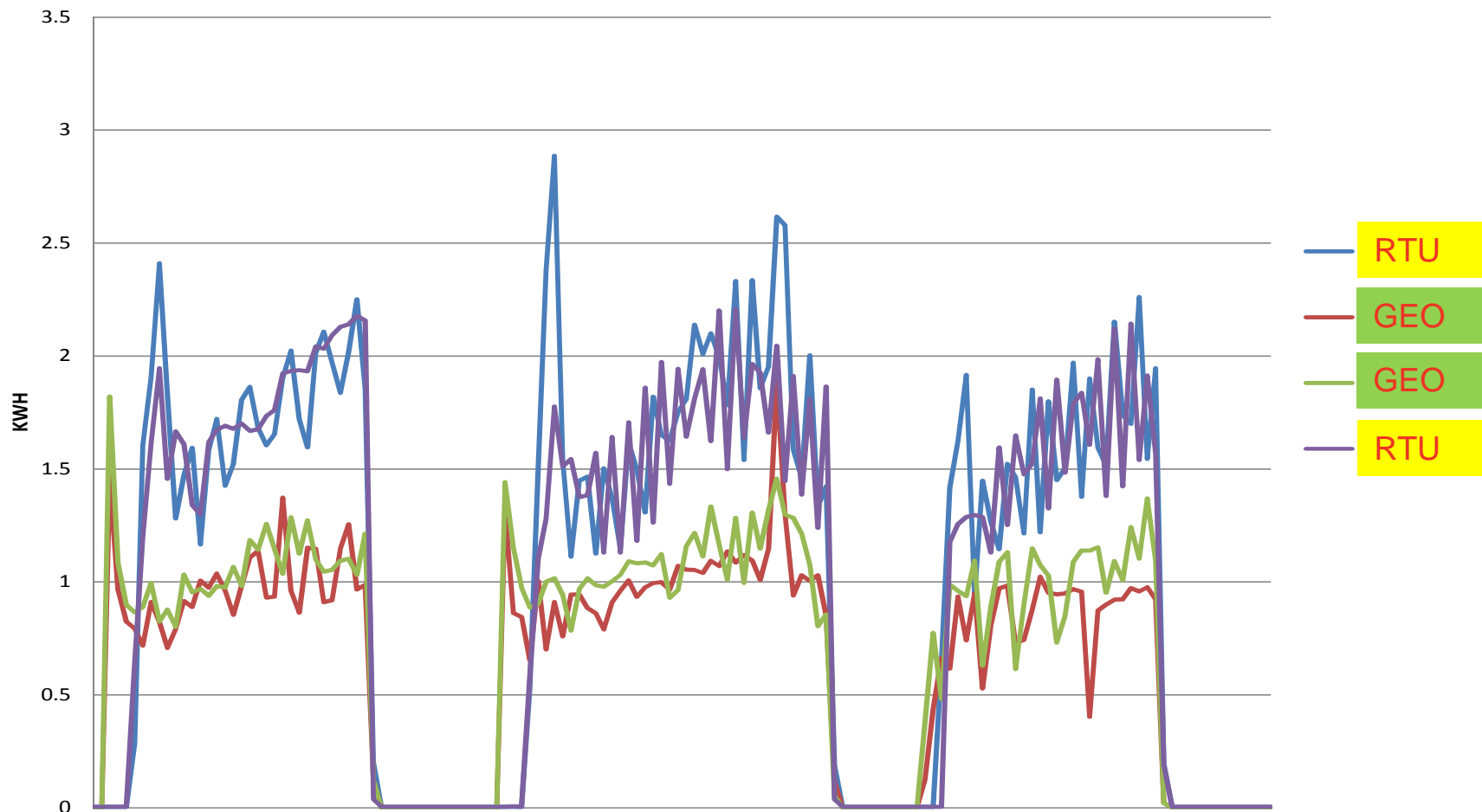
### Meter Reading Statistics

Max (¼ h) Demand	3.284 kW at 06/03 15:45	Peak ¼ hour	0.821 kWh at 06/03 15:45
Min ¼ hour	0.002 kWh at 05/30 00:30	Total	134.548 kWh
Avg	0.290 kWh	LF	34.14%
Estimated #s CO2	123.784		

GEOTHERMAL CLASSROOM      45% SAVINGS      RTU CLASSROOM

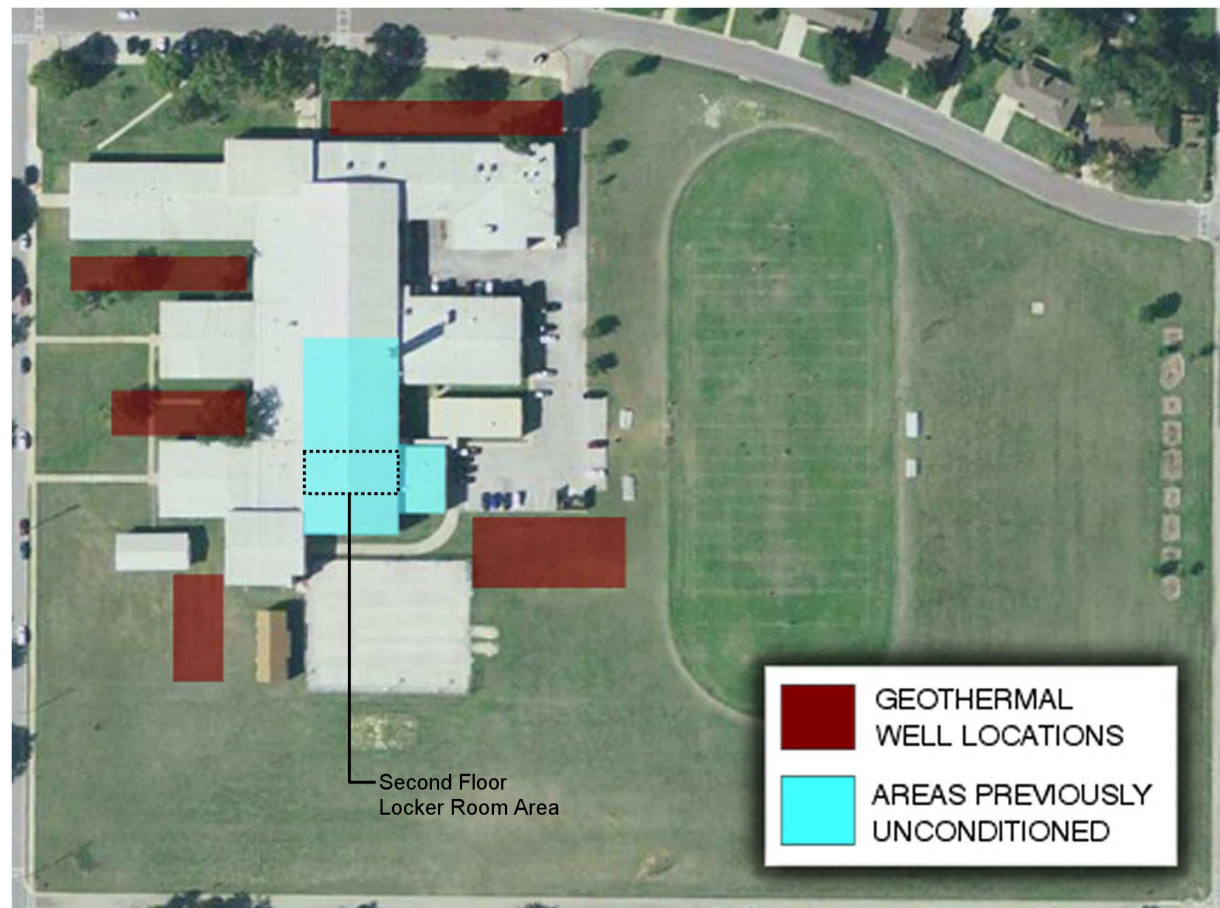
Desertview Elementary - Phoenix

# Desert View - August 10, 11, 12, 2011

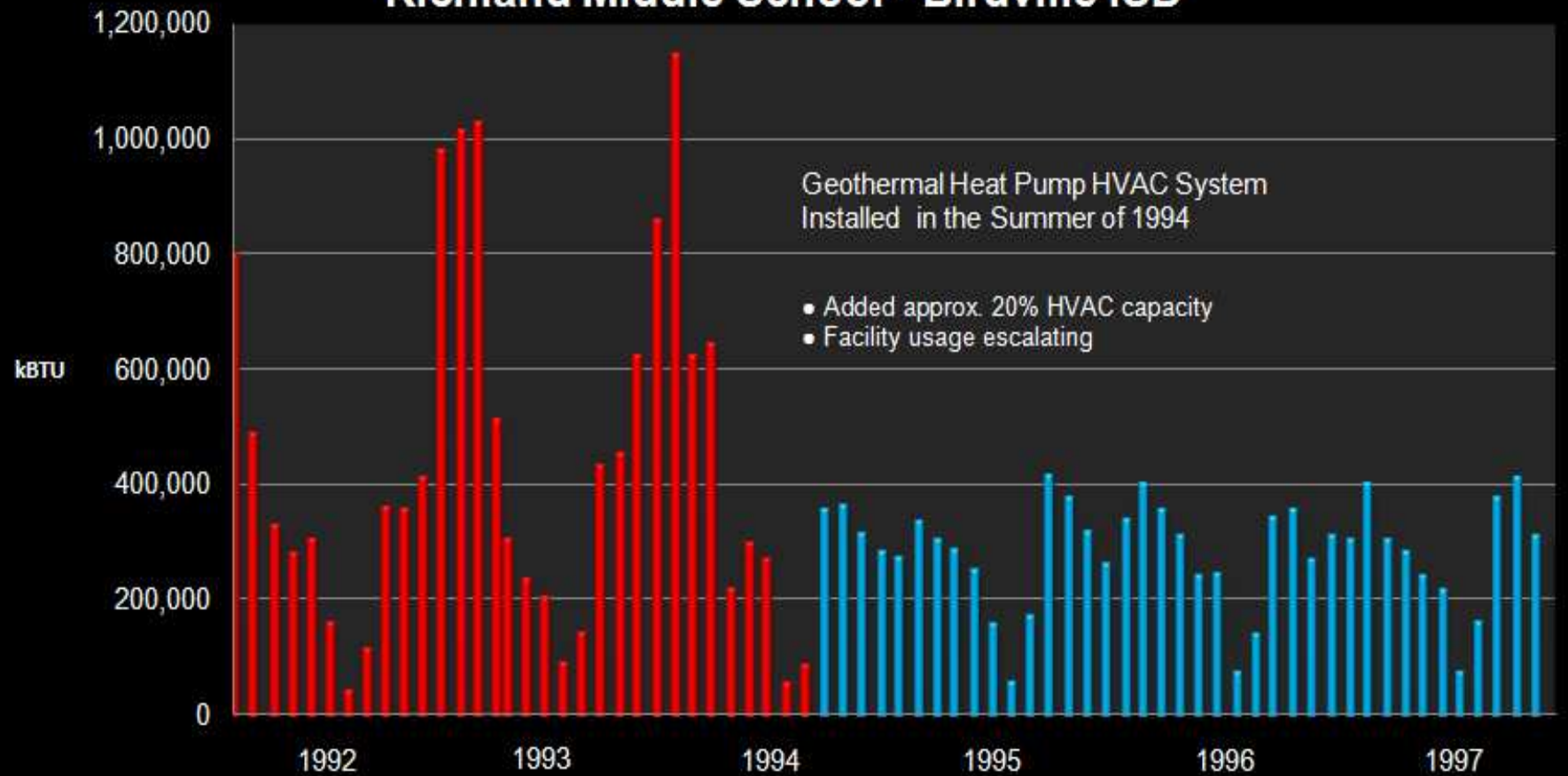


## **RICHLAND MIDDLE SCHOOL**

### Geothermal Conversion of Entire School



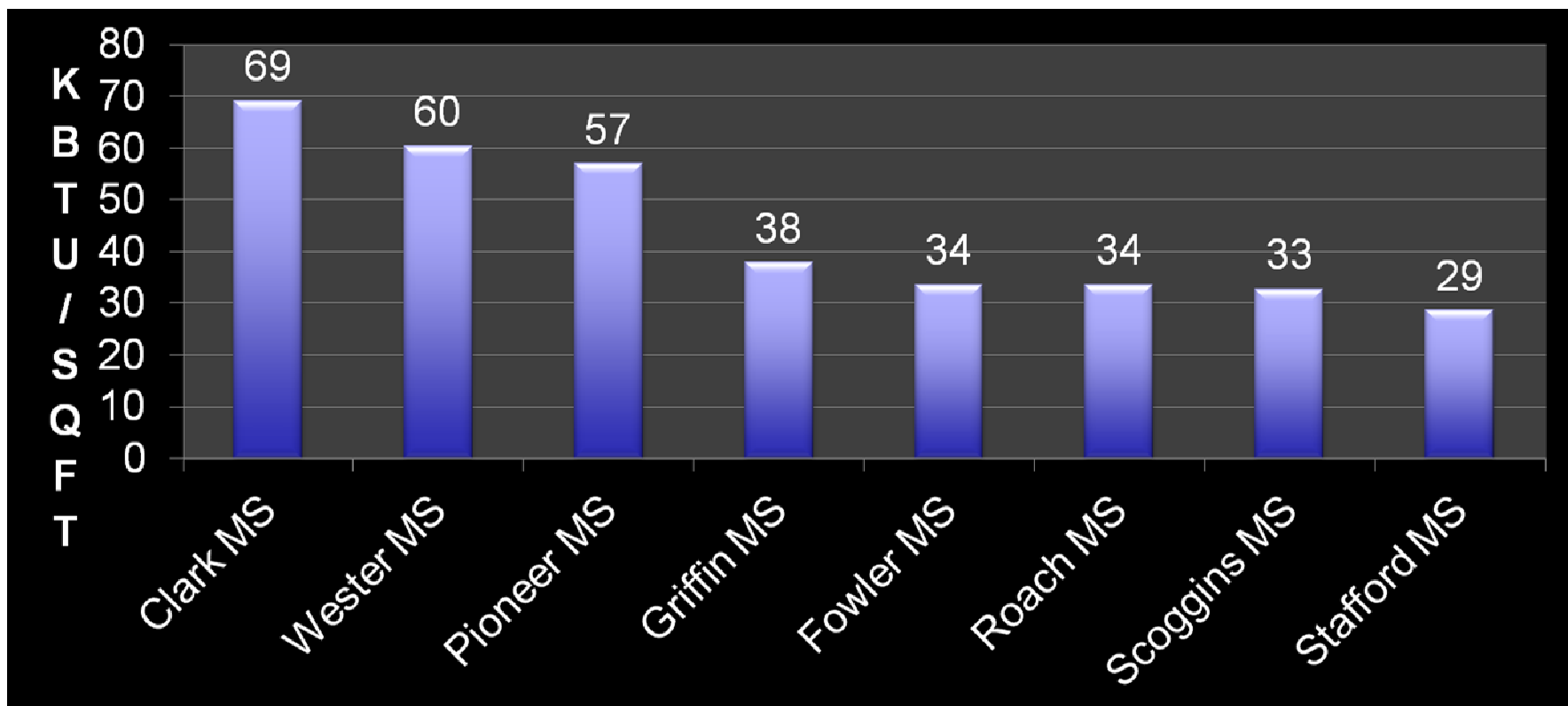
## Richland Middle School - Birdville ISD



## FRISCO ISD MIDDLE SCHOOLS COMPARISON – YEAR 2008 – 2009

Schools – Clark thru Wester are Chilled/Heating Water Systems

Schools – Griffin and Roach are Geothermal Heat Pump Systems

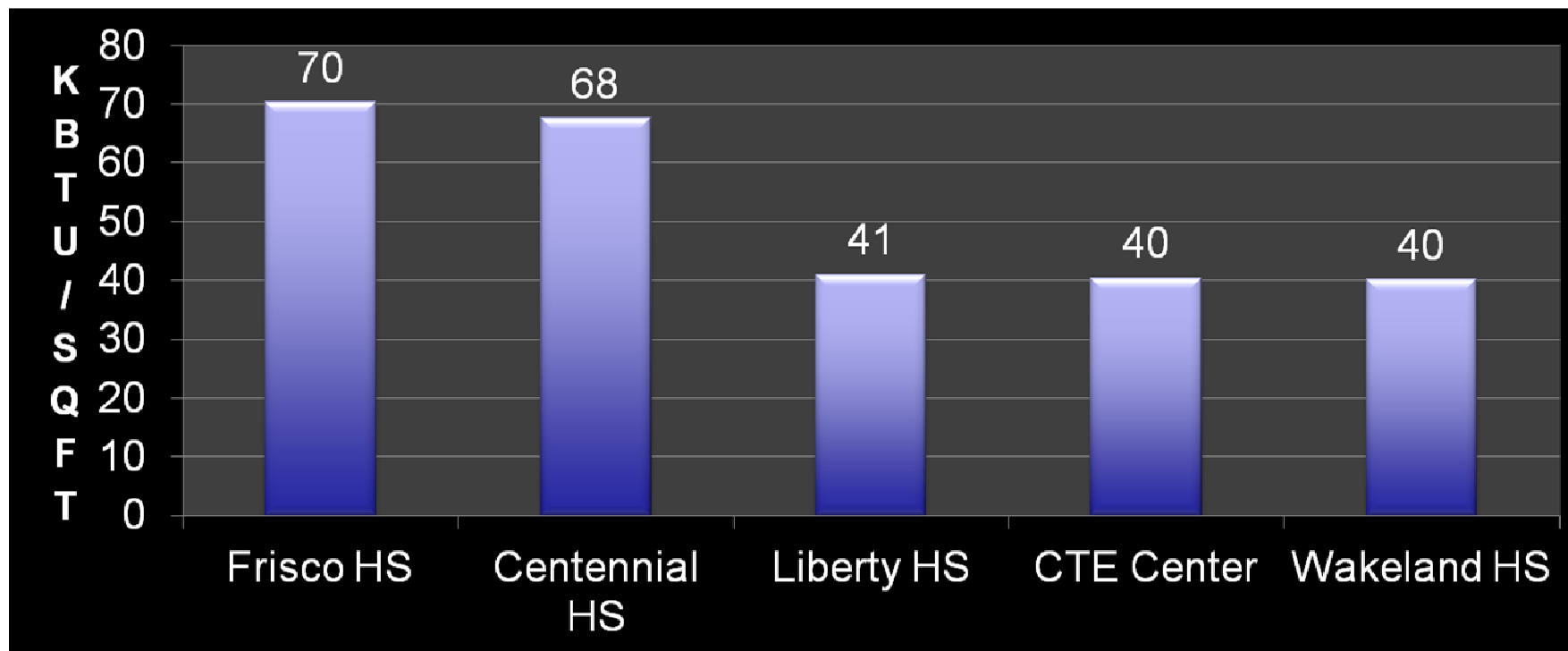


## FRISCO ISD HIGH SCHOOLS COMPARISON – YEAR 2008-2009

Frisco HS – Chilled/Heating Water System

Centennial HS – Chilled/Heating Water System – Thermal Storage

Wakeland/Liberty/CTE Center HS – Geothermal Heat Pump System





*Table C-8a. Statistics for Total HVAC Maintenance Costs  
for Individual Facilities with In-House HVAC Maintenance Personnel  
When Classified by Type of Distribution System Used in Facilities\*  
(Costs in Cents per Square Foot)*

Type of Distribution System	Number of Facilities	Mean Cost	Standard Deviation	25th Percentile Cost	Median Cost	75th Percentile Cost
Single zone	30	53.08	70.49	15.70	31.60	61.90
Multi-zone	21	45.49	34.54	21.90	30.00	68.00
Dual duct	8	48.41	30.82	23.95	55.55	68.90
Variable-air-volume	52	38.26	44.36	9.45	26.95	51.90
Constant volume	23	47.25	36.95	19.70	37.50	78.80
Two-pipe fan coil	12	36.58	30.36	8.15	36.00	55.70
Three-pipe fan coil	1	44.00	n/a	44.00	44.00	44.00
Four-pipe fan coil	8	53.05	34.17	31.95	44.65	81.35
Induction	6	57.48	37.16	39.10	46.15	92.50
Baseboard and finned-tube radiation	1	78.20	n/a	78.20	78.20	78.20
Radiant panel	3	38.10	30.75	8.40	36.10	69.80
Unit ventilators	7	67.46	54.18	8.40	68.00	131.30
Valance unit	1	69.80	n/a	69.80	69.80	69.80
Packaged terminal air conditioners	6	48.55	36.79	8.40	52.95	69.80
Water-source heat pumps	4	113.85	109.20	50.90	74.30	176.80
Packaged terminal heat pumps	1	69.80	n/a	69.80	69.80	69.80
Geothermal heat pump system	41	18.44	26.09	3.70	6.70	20.20
Other heat pump system	4	56.00	67.40	11.30	31.75	100.70
Other types	24	8.73	10.39	1.95	5.85	11.35



# GEOHERMAL PRESENTATION



IEG		INITIAL COST				LONG TERM COSTS						LIFE EXPECTANCY	APPLICATIONS		REMARKS
SYSTEM	DESCRIPTION	NEW	UNIT	RENOV/ REPLACE	UNIT	REASON	FREQ	COST	UNIT	30 YEAR LIFE CYCLE COST	UNIT	YEARS	BENEFITS	CHALLENGES	
Rooftop Packaged DX Units with Gas Heat; minimum efficiency required to meet Energy Code	Min Eff RTUs	\$14.17	sq ft	\$12.50	sq ft	Maintenance	annually	\$0.60	sq ft	\$60.67	sq ft	15	Energy consumption at point of use	Multiple large roof penetration, susceptible to hail/weather events	Simple system; Cost for replacement included at Year 15
Rooftop Packaged DX Units with Gas Heat; High Efficient Rooftop with integral Demand Control Ventilation and Economizer	High Eff RTUs	\$16.67	sq ft	\$15.00	sq ft	Maintenance	annually	\$0.80	sq ft	\$62.07	sq ft	15	Energy consumption at point of use	Multiple large roof penetration, susceptible to hail/weather events, complicated controls	More complex controls, multiple stages of heating and cooling with demand control ventilation; Cost for replacement included at Year 15.
4-Pipe Water Cooled Chiller System with Gas Fired Boiler	4-Pipe Water Cooled	\$20.67	sq ft	\$20.67	sq ft	Maintenance	annually	\$0.80	sq ft	\$62.74	sq ft	30	Consolidated equipment rooms	high maintenance costs and requires specialized technician	Should provide enhanced humidity control. System based on individual fan coils at classroom level.
4-Pipe Air Cooled Chiller System with Gas Fired Boiler	4-Pipe Air Cooled	\$19.33	sq ft	\$19.33	sq ft	Maintenance	annually	\$0.80	sq ft	\$63.13	sq ft	30	Consolidated equipment rooms	high maintenance costs and requires specialized technician	Should provide enhanced humidity control. System based on individual fan coils at classroom level.
Geothermal Heat Pumps with demand pumping	Geothermal Heat Pumps with demand pumping	\$18.00	sq ft	\$16.67	sq ft	Maintenance	annually	\$0.22	sq ft	\$43.84	sq ft	30	Energy savings; Energy consumption at point of use	control of digging on site and locating well fields	Simple system; EPA and DOE have classified as the most efficient effective HVAC System. Can be designed with requirement for mechanical room.
Geothermal Heat Pumps with central pumping	Geothermal Heat Pumps with central pumping	\$20.00	sq ft	\$18.45	sq ft	Maintenance	annually	\$0.45	sq ft	\$51.63	sq ft	30	Energy Savings over other non geo systems	control of digging on site and locating well fields, requires mechanical room for pumps	Complex system; not as efficient as demand pumping scheme, higher first cost than demand pumping scheme, requires mechanical room
Water Source Heat Pumps, Cooling Tower and Boiler Condenser Water Loop	Water Source Heat Pumps, Cooling Tower and Boiler Condenser Water Loop	\$17.33	sq ft	\$17.33	sq ft	Maintenance	annually	\$1.76	sq ft	\$81.21	sq ft	30		high maintenance costs and requires specialized technician	Problematic and central pumping arrangement is costly, highest maintenance cost of all HVAC Systems